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Manuring Experiments on Rubber.

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The experiments to be described were initiated and carried out by the writer on an estate in Perak.

The primary object of the experiments was to ascertain the influence of different manures on the yield of dry rubber, but careful records were also kept of the increase in girth of the trees in the different plots.

The experimental area consisted of eight $2\frac{1}{2}$ acre plots, each of which was duplicated, so that it comprised no less than 40 acres containing over 4,500 trees planted at a distance of 20 ft. x 20 ft., or 108 trees per acre. The land under experiment was perfectly flat, each $2\frac{1}{2}$ acre plot being completely isolated by a 3 feet drain and therefore ideal for carrying out manuring experiments.

The trees were about six years old and those in bearing had all been tapped on the same system, 2 cuts half herring bone, for a period of about 18 months previous to starting the experiment.

CHARACTER OF THE SOIL.

The soil on which the experiments were carried out consisted of a fairly rich loam of a peaty nature overlying an alluvial clay sub-soil. It should be noted that for several years previous to the planting of rubber the land had been very heavily cropped with sugar and tapioca which may have exhausted the soil of available plant food and no doubt was responsible for the very low yields of rubber obtained throughout the estate.

The analysis of the soil, though it is recognised that chemical composition affords little or no guide to manuring, is given below.

CHEMICAL ANALYSIS. (Barrowcliff). %

Moisture	4.90
Volatile and Organic Matter ..	26.90
Alumina (Al_2O_3)	7.33
Iron Oxide (Fe_2O_3)	1.57
Calcium Oxide (CaO)	0.18
Magnesium Oxide (MgO)	0.32
Potash (K_2O)	0.37
Phosphoric Acid (P_2O_5)	0.13
Insoluble Silica etc.	64.80
The above containing:—	
Nitrogen	0.76
Available Potash	0.015
„ Phosphoric Acid	0.043

The soil was somewhat sour, having an acidity equivalent to from 4 to 6 tons of lime per acre.

SELECTION OF SITE.

The experiments were carried out in duplicate and in each case the area was carefully selected so that the plots as far as possible should show even growth at the commencement of the trials. The plots were again inspected before the manures were applied but very little difference was observed between them in the general appearance, if anything the control No. 8A showed slightly better foliage than the adjoining plots.

TREATMENT OF EXPERIMENTAL PLOTS.

The following is a list of manures and the amounts applied per acre, the costs given including application:—

Plot 1A and 1B

Sulphate of Ammonia (N 20%) ..	$\frac{1}{2}$ cwt.
Sulphate of Potash (K_2O 50%) ..	$\frac{1}{2}$ „
Perlis Guano (P_2O_5 18%)	2 „
Lime	5 „
Cost per acre = \$17.37	

Plots 2A and 2B

Sulphate of Ammonia	1 cwt.
Lime	5 „
Cost per acre = \$14.32	

Plots 3A and 3B

Sulphate of Potash	1 cwt.
Lime	5 „
Cost per acre = \$12.64	

Plots 4A and 4B

Perlis Guano	..	..	..	4 cwts.
Lime	..	..	..	5 „

Cost per acre = \$13.20

Plots 5A and 5B

Basic Slag (P_2O_5 20%)	..	..	..	4 cwts.
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Cost per acre = \$10.76

Plots 6A and 6B

Lime	..	..	..	1 ton.
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Cost per acre = \$22.95

Plots 7A and 7B

Changkolled Control

Cost per acre = \$6.00

Plots 8A and 8B

Unchangkolled Control.

As will be seen above there were two controls in each set of experiments, Nos. 7A and 7B changkolled and Nos. 8A and 8B unchangkolled. All the plots were clean weeded monthly throughout the experiment.

The soil was very deficient in lime so it was considered advisable to apply 5 cwts. of lime to plots No. 1, 2, 3 and 4 in each set of experiments in order to get full benefit from the manures applied.

The lime was obtained in the form of quicklime and by leaving it in an open shed for about 3 days it was allowed to slake to a fine powder which allowed of more even distribution. The limed plots were gone over again the day after the lime was applied and any unslaked lumps of the previous day were spread over the plots.

As basic slag contains a certain amount of free lime it was considered unnecessary to apply lime to plots Nos. 5A and 5B.

The system of tapping was the same in both sets of experiments and consisted of two cuts, 18 inches apart, tapped daily.

All of the plots, with the exception of Nos. 8A and 8B, were changkolled at the end of March.

The lime was applied to the plots, as stated above, at the beginning of April, 1913, or nearly two months before the application of manures so that there should be no loss due to the action of free lime on the manurial constituents.

The manures were applied to their respective plots between the 15th and 20th May, 1913, being spread broadcast all over the surface and lightly forked into the soil.

Measurements were taken of all the trees at 3 feet from the ground in June and December as a check on the increase in girth.

A complete record of the yields of the dry rubber and scrap was kept from the 1st June, 1913, until the end of April 1914 when the recording of yields was stopped; so that yields are only available for a period of 11 months.

The following is a record of rainfall for the period during which the experiments were carried out.

		Number of Wet Days.	Rainfall. Inches.
June 1913 ..	..	11	3.11
July ..	..	4	1.19
August ..	..	7	10.13
September ..	..	17	10.41
October ..	..	20	13.81
November ..	..	23	12.36
December ..	..	14	11.12
January 1914 ..	..	11	8.21
February ..	..	6	2.67
March ..	..	14	6.18
April ..	..	19	6.61
May ..	..	15	11.47
Total ..		161	97.27

RESULTS OF THE EXPERIMENTS.

From periodical observations the general appearance of the foliage was much healthier than that on the adjoining unmanured plots, the leaves being larger, more abundant and a richer green in colour. Little or no distinction could be made between individual plots.

The power of resisting drought was very evident over the whole of the manurial and changkollod plots, especially during the month of July which was very dry. During this month the yield for trees not under experiment was as low as 134 and 140 lbs. per 100 trees per annum for Blocks A and B respectively.

By changkolling, the surface is loosened and forms a mulch which breaks the capillary tubes thereby reducing the evaporation of moisture to a minimum. This would no doubt account for the increase during a period of drought.

In carrying out other experiments the writer has frequently noticed that during a dry season wintering is much less severe on areas where the soil has been lightly forked than on unforked areas.

Another important observation was the resistance to wind on the experimental plots; although the plots were deeply changkolled not a single tree was uprooted by wind, whilst surrounding trees not under experiment were frequently blown over and had to be staked. This is probably due to an increased root system, the application of manures causing the roots to penetrate deeper into the surrounding soil and sub-soil.

There was no disease on any of the plots, indicating that trees which have a healthy vigorous growth are less liable to attack.

YIELD OF DRY RUBBER.

Both the weights of No. 1 latex and the scrap rubber were kept for observation. All the rubber was kept separate until dry so that the weights recorded in Tables I. and II. are the actual yields per plot for each month, and for the purpose of comparison these weights have been calculated on the yield per 100 trees per annum as given in Tables III. and IV.

As will be seen from the figures given in the above tables, it is unfortunate that a further number of trees were brought into bearing at the beginning of September and the plotting of graphs will show a sudden drop in the yields at this period due to this factor. It may be noted in Experiments A that Plot No. 6A had the greatest number of trees introduced though it gave the highest yield throughout the experiments.

From an inspection of the yields given on Tables III. and IV. it will be noted that both the lime and the complete mixture plots come out well on top when compared with the controls. Taking the lime Plot 6A it gave an increase of 47.2 lbs. and 49.2 lbs. over the unchangkolled and changkolled controls respectively, whilst the yield for Plot 6B was 49.7 lbs. and 38.9 lbs. in excess of the controls.

The complete mixture Plot 1A gave an increase of 30.3 lbs. and 32.3 lbs. over the unchangkolled and changkolled controls, whilst the yields for Plot 1B were 53.9 lbs. and 43.1 lbs. above the controls.

The nitrogen plot gave almost a negative result on Plot 1A, whereas an increase was obtained on Plot 1B under similar treatment.

The potash Plot 3A gave an increase of 26.4 lbs. and 28.4 lbs. over the unchangkolled and changkolled controls, but the results were not confirmed on Plot 3B.

The Perlis guano plot gave increases over the unchangkolled control of 14.8 lbs. and 23.2 lbs. on Plots 1A and 1B respectively.

The basic slag plot gave an increase of 25.1 lbs. and 14.2 lbs. for Plots 5A and 5B respectively. Considerable improvement in yield was shown in these plots during the last five months of the experiment and by referring to Table V. it will be seen that at the end of six months the relative yields compared with the control (100) were 97 for Plot 6A and 92 for Plot 5B, whilst the relative yields at the end of 11 months were 112 for Plot 5A and 107 for Plot 5B.

Further reference to the yields given in Table VII. will show the comparative yields, calculated per 100 trees per annum, for the first and second periods as follows:—

Plot.	Treatment.	June to November.	Dec. to May.
		lbs.	lbs.
5A	Basic Slag	174.8	289.4
8A	Unchangkolled Control	179.8	232.6
6A	Basic Slag	173.8	283.2
8A	Unchangkolled Control	188.2	198.0

It should be remembered that the basic slag plots received no lime.

A careful comparison of the yields from the unchangkolled and changkolled controls in Tables III. and IV. shows that changkolling has an adverse effect on the yield for some considerable time. At the end of six months the relative yields compared with the unchangkolled control (100) for Plots 7A and 7B were 92 and 95 respectively, whilst the relative yields over 11 months were 99 for Plot 7A and 106 for Plot 7B (see Table V.). A further comparison can be made of the yields for the two periods June to November and December to May in Table VII.

It would appear from the above results that deep changkolling causes a falling off in yield, probably due to interference with the root system, but the falling off is only temporary and more than compensated for by the subsequent increase in yield when the trees have recovered from the ill effects.

INCREASE IN GIRTH.

Measurements of all the trees at 3 feet from the ground taken on June 1st 1913, December 1st 1913 and June 1st 1914 are given in Table VI.

Taking the results over 12 months the highest increase for Experiments A was shown by the lime plot (6A) with 4.33 inches and the lowest by the complete mixture plot (1A) with 3.15 inches. The highest increase for Experiments B was also shown by the lime plot (6B) with 4.20 inches, whilst the lowest was the unchangkolled control with 3.36 inches.

RELATION BETWEEN YIELD AND GIRTH INCREASE.

A study of the figures given in Table VII. points to the fact that there is a distinct relation between the yield and the increase in girth. In this first period when the yields are lowest the girth increase is greatest, whereas in the second period when the yields improve the girth increase shows a considerable falling off. Taking the whole sixteen plots they all increased in yield during the second period, but with three exceptions (Plots 6A, 8A, and 5B) they all showed a falling off in girth increase. It should be noted that in the case of Plot 6A although the girth increase in the second period was larger than in the first the yield was practically the same.

Whether it is the development of the trees which affects the yields, or vice versa, is a matter of considerable importance and one worthy of further investigation.

INFLUENCE OF MANURES ON No. 1 LATEX.

Reference to Tables VIII. and IX. will show the yields of No. 1 latex and scrap for Experiments A from June to November, and, although considerable differences are to be found in the total yields, the yield of scrap rubber remains almost constant. A comparison of the highest and lowest yield clearly illustrates this point.

Plot.	Total Yield. lbs.	Yield No.1 Latex. lbs.	Yield Scrap Rubber lbs.
6A	247.2	201.6	45.6
7A	165.0	122.0	42.8

As a general rule it may be taken that any increase in yield due to manuring will consist of No. 1 latex. There are exceptions, however, and some nitrogenous manures, especially nitrate of soda, have been known considerably to increase the percentage of scrap rubber.

GENERAL CONCLUSIONS.

Taking the yields of the lime and the complete mixture plots, they both show substantial increases when compared with the controls and the results obtained are confirmed in the duplicate plots. Basic slag appears to have increased the yield to an appreciable extent and in both sets of the experiments this plot was below the unchangkolled control at the end of six months, but it made the greatest increase for the last five months when compared with other plots. This tends to show that basic slag is somewhat slow in its action.

Taking the other manurial plots the differences in yield are too small to make comparative values on the effect of the different manures and therefore impossible to draw any definite conclusions from the results. It is noteworthy, however, that a combination of the three manures with the addition of 5 cwt. of lime gave considerable increase in yield.

A comparison of the figures given in Table X. shows that lime when compared with the controls 8A and 8B increased the yield per 100 trees per annum to 47.2 lbs. in Plot 6A and 49.7 lbs. in Plot 6B at a cost of \$22.95 per acre. When it is remembered that any increase in yield will cost nothing to collect the results leave quite a margin of profit after deducting the cost of the manure.

The effect of lime as a plant-food is of little importance but its value in its action of rendering unavailable plant food available cannot be overestimated. It acts indirectly on the stores of unavailable plant food liberating them and making them available for the plant.

There are a number of acid soils in Malaya and as fungoid diseases are usually more prevalent on such soils the application of lime will help to neutralise the acidity and might assist in reducing the loss of trees from disease and at the same time have quite an appreciable effect in increasing the yield of latex.

TABLE I.
Actual Monthly Yields per plot and Number of Trees Tapped.
 EXPERIMENTS A.

Plot.	Trees Tapped.	June.	July.	Aug.	Trees Tapped.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	Total Yield.	Average No of Trees Tapped.	Average Yield per 100 Trees per an. num.
		lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs
1 A	217	44.71	36.74	40.75	258	34.11	44.96	50.14	57.00	69.31	58.63	50.06	46.13	532.54	247	235.2
2 A	213	29.62	32.93	32.93	256	30.95	35.91	38.83	62.50	67.81	49.06	35.69	42.75	458.98	244	205.2
3 A	218	35.04	37.44	43.81	241	39.47	46.78	41.59	64.00	53.69	47.31	46.06	43.06	498.25	235	231.3
4 A	218	40.87	31.38	36.82	246	33.02	41.08	36.76	59.25	52.38	61.19	43.38	43.25	479.38	238	219.7
5 A	177	26.97	27.93	23.19	220	29.60	33.70	31.60	51.06	55.06	58.44	56.81	44.00	438.36	208	230.0
6 A	206	30.69	37.56	39.50	269	46.61	68.92	69.71	61.00	62.81	63.44	53.44	48.69	582.37	252	252.1
7 A	197	25.95	27.56	27.44	249	31.86	34.59	36.47	54.56	50.81	53.68	50.75	43.19	437.06	235	202.9
8 A	217	32.55	28.25	30.17	253	33.62	40.27	46.36	49.94	48.44	49.88	52.31	44.69	456.48	243	204.9

TABLE II.
Actual Monthly Yields per plot and Number of Trees Tapped.
 EXPERIMENTS B.

Plot.	Trees Tapped.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	Total Yield.	Average No. of Trees Tapped.	Average Yield per 100 Trees per annum.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.
1 B	203	30.03	35.43	40.57	35.54	36.52	49.24	45.25	63.19	61.50	58.25	45.81	501.33	222	246.3
2 B	208	26.48	32.00	32.86	30.41	38.46	42.43	45.89	57.63	53.25	52.94	46.88	459.03	226	221.6
3 B	255	25.15	41.93	43.93	44.64	49.06	45.87	53.69	56.31	52.63	53.38	45.31	511.90	269	207.6
4 B	213	22.52	32.94	30.50	30.10	43.51	46.88	45.31	54.44	49.44	52.25	50.50	458.39	232	215.6
5 B	225	23.25	35.62	33.00	29.49	38.92	43.05	46.38	51.50	52.31	48.81	48.38	450.71	238	206.6
6 B	214	25.35	37.25	38.50	35.32	41.00	46.69	52.88	59.88	54.81	56.81	50.88	499.37	225	242.1
7 B	224	23.55	36.50	36.03	30.27	43.53	41.75	39.38	51.56	54.94	49.94	43.31	450.76	242	203.2
8 B	132	21.90	20.09	21.17	25.59	28.47	26.81	26.69	30.25	26.38	30.88	29.28	287.51	163	192.4

TABLE III.
Monthly Yields Calculated per 100 trees per annum.
 EXPERIMENTS A.

Plot.	Trees Tapped.	June.	July.	Aug.	Trees Tapped.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	Average No. of Trees Tapped.	Average Yield per 100 Trees per annum.
		lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs..
1 A	217	247.2	203.1	225.3	258	158.6	209.1	233.2	265.1	322.3	272.6	232.8	214.5	247	235.2
2 A	213	166.8	185.5	185.5	256	145.0	168.3	182.0	292.9	317.8	229.9	167.2	200.3	244	205.2
3 A	218	192.8	206.0	241.1	241	196.5	232.9	207.2	318.6	267.3	235.5	229.3	214.4	235	231.3
4 A	218	224.9	172.7	202.6	246	161.0	200.3	179.3	289.0	255.5	298.4	211.6	210.9	238	219.7
5 A	177	182.8	189.3	157.2	220	161.4	183.8	172.3	278.5	300.3	318.7	309.8	240.0	208	230.0
6 A	206	178.7	218.7	230.0	269	207.8	307.4	310.9	272.1	280.1	283.0	238.3	217.2	252	252.1
7 A	197	158.0	167.8	167.1	249	153.5	166.6	175.7	262.9	244.8	259.6	244.5	208.1	235	202.9
8 A	217	180.0	156.2	166.8	253	159.4	191.0	219.8	236.8	229.7	236.5	248.1	211.9	243	204.9

TABLE IV.
Monthly Yields Calculated per 100 trees per annum.
 EXPERIMENTS B.

Plot	Trees Tapped.	June.	July.	Aug.	Trees Tapped.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	Average No. of Trees Tapped.	Average Yield per 100 Trees per annum.
		lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.
1 B	203	177.5	209.4	239.8	229	186.2	191.3	258.0	237.1	331.1	322.2	305.2	240.0	222	246.3
2 B	208	152.7	184.6	189.5	233	155.5	198.0	218.5	236.3	296.8	274.2	272.6	241.4	226	221.6
3 B	255	118.3	197.3	206.7	274	195.5	214.8	200.8	235.1	246.6	230.4	233.7	198.4	269	207.6
4 B	213	126.8	185.5	171.8	239	151.1	218.4	235.3	227.4	273.3	248.2	262.3	253.5	232	215.6
5 B	225	124.0	189.9	176.0	243	145.6	192.1	212.5	229.0	254.3	258.3	241.0	238.9	238	206.6
6 B	214	142.1	208.8	215.8	229	185.0	214.8	244.6	277.1	313.7	287.2	297.6	266.6	225	242.1
7 B	224	126.1	195.5	193.0	249	145.8	209.7	201.2	189.7	248.4	264.7	240.6	208.7	242	203.2
8 B	132	199.0	182.6	152.4	174	176.4	196.3	184.8	184.0	203.6	181.9	212.9	201.9	163	192.4

TABLE V.

Yields of Rubber at 6 and 11 Months.

No. of Plot.	YIELDS AT END OF 6 MONTHS.			Relative Yields Control = 100.	YIELDS AT END OF 11 MONTHS.			Relative Yields Control = 100.
	Total Yield.	Average No. of trees tapped.	Yield per 100 trees per annum.		Total Yield.	Average No. of trees tapped.	Yield per 100 trees per annum.	
	lbs.		lbs.		lbs.		lbs.	
1 A	251.41	237	212.2	118	532.54	247	235.2	115
2 A	201.17	234	172.0	96	458.98	244	205.2	101
3 A	244.13	229	213.2	119	498.25	235	231.3	113
4 A	219.93	232	190.4	106	479.38	238	219.7	107
5 A	172.99	198	174.8	97	438.36	208	230.0	112
6 A	292.99	237	247.2	138	582.37	252	252.1	123
7 A	183.87	223	165.0	92	437.06	235	202.9	99
8 A	211.22	235	179.8	100	456.48	243	204.9	100
1 B	227.33	216	210.4	112	501.33	222	246.3	128
2 B	202.44	220	180.4	97	459.03	226	221.6	115
3 B	250.58	264	189.8	101	511.90	269	207.6	108
4 B	206.45	226	182.6	97	458.39	232	215.6	112
5 B	203.33	234	173.8	92	450.71	238	206.6	107
6 B	224.11	221	202.4	108	499.37	225	242.1	126
7 B	211.63	236	179.4	95	450.76	242	203.2	106
8 B	144.03	153	188.2	100	287.51	163	192.4	100

TABLE VI.

Increase in Girth from June 1913 to June 1914.

No. of Plot.	Average Girth June 1913.	Average Girth Dec. 1913.	Increase June to December.	Average Girth June 1914.	Increase Dec. 1913 to June 1914.	Total Increase June 1913 June 1914.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1 A	17.64	20.30	2.66	20.79	0.49	3.15
2 A	17.67	19.89	2.22	21.06	1.17	3.39
3 A	17.76	19.86	2.10	21.37	1.51	3.61
4 A	17.85	19.95	2.10	21.35	1.40	3.50
5 A	16.76	18.67	1.91	20.06	1.39	3.30
6 A	18.23	20.30	2.07	22.56	2.26	4.33
7 A	17.92	19.80	1.88	21.18	1.38	3.26
8 A	17.29	18.83	1.54	20.51	1.68	3.22
1 B	19.03	21.10	2.07	23.02	1.92	3.99
2 B	18.78	21.10	2.32	22.91	1.81	4.13
3 B	18.77	20.77	2.00	22.42	1.65	3.65
4 B	18.76	21.11	2.35	22.82	1.71	4.06
5 B	19.39	21.30	1.91	23.51	2.21	4.12
6 B	18.43	21.14	2.71	22.63	1.49	4.20
7 B	19.14	21.50	2.36	23.15	1.65	4.01
8 B	16.42	18.52	2.10	19.78	1.26	3.36

TABLE VII.

Relation between Girth Increase and Yield of Rubber.

No of Plot.	Manure Applied,	June to Nov 1913		Dec. 1913 to May 1914.	
		Girth Increase.	Yield per 100 Trees per annum.	Girth Increase.	Yield per 100 Trees per annum.
		Inches.	lbs.	Inches.	lbs.
1 A	Complete Mixture	2.66	212.2	0.49	261.6
2 A	Sulphate of Ammonia	2.22	172.0	1.17	241.7
3 A	Sulphate of Potash	2.10	213.2	1.51	253.0
4 A	Perlis Guano	2.10	190.4	1.40	253.0
5 A	Basic Slag	1.91	174.8	1.39	289.4
6 A	Lime	2.07	247.2	2.26	258.2
7 A	Changkolled Control	1.88	165.0	1.38	244.1
8 A	Unchangkolled Control	1.54	179.8	1.68	232.6
1 B	Complete Mixture	2.07	210.4	1.92	287.3
2 B	Sulphate of Ammonia	2.32	180.4	1.81	264.2
3 B	Sulphate of Potash	2.00	189.8	1.65	229.0
4 B	Perlis Guano	2.35	182.6	1.71	253.0
5 B	Basic Slag	1.91	173.8	2.21	283.2
6 B	Lime	2.71	202.4	1.49	288.5
7 B	Changkolled Control	2.36	179.4	1.65	230.4
8 B	Unchangkolled Control.	2.10	188.2	1.26	198.0

TABLE VIII.
Actual Monthly Yield of No. 1 Latex per plot.
 EXPERIMENT A.

Plot.	June.	July.	Aug.	Sept.	Oct.	Nov.	Total.	Average No. of Trees Tapping.	Yield per 100 Trees per annum.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.
1 A	33.59	31.30	31.06	24.49	36.40	41.70	198.54	237	167.6
2 A	20.50	26.37	26.00	24.07	28.10	30.14	155.18	234	132.6
3 A	25.66	28.75	34.25	32.22	40.84	35.53	197.25	229	172.2
4 A	30.87	25.38	26.38	25.58	32.71	30.32	171.24	232	147.6
5 A	20.91	21.80	16.50	21.54	25.71	24.97	131.43	198	132.8
6 A	23.88	29.31	31.81	37.23	56.80	59.84	238.87	237	201.6
7 A	17.70	20.25	20.00	23.30	26.65	28.16	136.06	223	122.0
8 A	25.67	22.94	22.48	24.49	32.96	36.05	164.59	235	140.0

TABLE IX.
Actual Monthly Yield of Scrap Rubber per plot.
 EXPERIMENT A.

Plot.	June.	July.	Aug.	Sept.	Oct.	Nov.	Total.	Average No of Trees Tapping.	Yield per 100 Trees per annum.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.
1 A	11.12	5.44	9.69	9.62	8.56	8.44	52.87	237	44.6
2 A	9.12	6.56	6.93	6.88	7.81	8.69	45.99	234	39.2
3 A	9.38	8.69	9.56	7.25	5.94	6.06	46.88	229	41.0
4 A	10.00	6.00	10.44	7.44	8.37	6.44	48.69	232	42.0
5 A	6.06	6.13	6.69	8.06	7.99	6.63	41.56	198	42.0
6 A	6.81	8.25	7.69	9.38	12.12	9.87	54.12	237	45.6
7 A	8.25	7.31	7.44	8.56	7.94	8.31	47.81	223	42.8
8 A	6.88	5.31	7.69	9.13	7.31	10.31	46.63	235	39.6

TABLE X.

Record of Yields, Girth Increase and Cost of Manures.

Plot.	Manure Applied.	Yield per 100 trees per annum.	Increase over unchang- kolled control.	Girth Increase per annum.	Cost of Manure per acre.
		lbs.	lbs.	inches.	\$
6 A	Lime	252.1	47.2	4.33	22.95
1 A	Complete Mixture	235.2	30.3	3.15	17.37
3 A	Sulphate of Potash	231.3	26.4	3.61	12.64
5 A	Basic Slag	230.0	25.1	3.30	10.76
4 A	Perlis Guano	219.7	14.8	3.50	13.20
2 A	Sulphate of Ammonia	205.2	nil.	9	14.32
8 A	Unchangkolled Control	204.9	—	3.22	nil
7 A	Changkolled Control	202.9	nil.	3.26	6.00
1 B	Complete Mixture	246.3	53.9	3.99	17.37
6 B	Lime	242.1	49.7	4.20	22.95
2 B	Sulphate of Ammonia	221.6	29.2	4.13	14.32
4 B	Perlis Guano	215.6	23.2	4.06	13.20
3 B	Sulphate of Potash	207.6	15.2	3.65	12.64
5 B	Basic Slag	206.6	14.2	4.12	10.76
7 B	Changkolled Control	203.2	10.8	4.01	6.00
8 B	Unchangkolled Control	192.4	—	3.36	nil

Summary of the Locust Work for the 4th Quarter, 1915.

BY F. W. SOUTH.

The destruction of hoppers proceeded throughout the quarter in the Negri Sembilan and Johore and good results were obtained. No particular damage was done by the locusts and the position at the close of the year was satisfactory.

SELANGOR.

During this quarter no locusts work of any importance occurred in the State. At the beginning of the period two flying swarms were present, one near the Kuchai Road and the other in the vicinity of Serdang and Cheras. These swarms afterwards united. Another swarm came in from the Negri Sembilan about the middle of December and went to Semenyih where it stayed until the end of the year.

NEGRI SEMBILAN.

The destruction of hoppers commenced about the end of September and was concluded by the beginning of December with the exception of a fortnight's work on Devon Estate in the Coast District in the middle of December. At the close of the year there were only 3 flying swarms in the Seremban district, about 12 swarms at the most in the Tampin district, while it appeared, as far as could be ascertained, that there were none in the Coast District as such flying swarms as were known to be present in the earlier part of the quarter moved southward, presumably into Malacca at the end of the year.

Seremban District. Destruction work commenced here on October 26th on hoppers which hatched out round Seremban town as far as the 6½ mile on the Kuala Pilah Road, the 4th mile on the Jelebu Road, the 2nd mile on the old Jelebu Road and at Rahang. One small swarm was found at Mambau and destroyed. The Malays are recommencing to plant up their padi sawahs in this district now that they find that the number of locusts has materially decreased and that they are seldom visited by this pest. The work finished at about the end of November and only in a few cases did hoppers develop into fliers. There was one big swarm of fliers at Sungei Gadut which is believed to have bred unchecked in some undiscovered patch of lalang and two other flying swarms were known in the Vicinity of the 7th and 8th miles on the Kuala Pilah Road.

Coast District. Work was carried on from the end of September up to the middle of December, when 5th instar hoppers

were poisoned among the lalang on Devon Estate. Poison work during this last breeding season for the year was carried on from the 6th to the 23rd mile on the Coast road and down nearly to the Linggi river. Work was also done on Sua Betong estate.

Flying swarms were hovering over most of this portion of the district at the end of the year, but gradually dispersed, towards Malacca it was thought.

Tampin District. Poisoning was carried on along the railway line near Keru and at Batang Malacca and thence along the Gemenchah Road. Work was also done on Repoh Estate and at Ulu Gemenchah, while an important centre was around See Kee estate and near Kopis in the triangle between the Johol-Kuala Jelei and Johol-Kuala Pilah Roads. The poison method only was used and on an average 70 sprayers were employed. Fliers escaped at Ayer Kuning as the sprayers were all in use and could not be got there in time.

The flying swarms in this District are being kept under observation, their number was not stated, but I understand that it does not exceed 12 at the most.

JOHORE.

Tangkak. During the end of September and the whole of October small swarms of hoppers kept appearing near Tangkak at intervals and had to be destroyed. On November 6th the work began again on freshly hatched swarms of hoppers and it continued until the end of December when no more hoppers were found.

Sungei Mati. There was no destruction work in this neighbourhood during the quarter, but two flying swarms were present at the end of the year, one at Kuala Kesang and the other at Pengkalan Besar. That at Kuala Kesang is believed to have laid eggs on the Sungei Mati side of the river.

Muar River, Panchor. Destruction work was carried out in this district from November 21st to December 17th when all the hoppers were destroyed. Since then no further flying swarms have been seen although two were expected in the district. One from Tanjong Selabok and one from Batu Pahat.

Batu Anam. Hoppers appeared between Buloh Kasap and Segamat at the end of November, but work was not started until December 1st owing to a delay on the part of the Post Office in cashing a money order. The work continued throughout December and was not quite completed at the end of the year.

During the quarter the flying swarms in Johore have been watched carefully, so far as the nature of the country will permit. The results obtained in destruction work during the quarter have been satisfactory.

Table of Results. October 1st to December 31st 1915.

District	Locality	Dates	Swarms Driven	Tins.	Swarms Poisoned	Total Swarms.
Negri Sembilan Seremban	Around Seremban town to the East as far as 6½ mile, Kuala Pilah Road.	October 26 to November 30th	37	470	197	234
	Mambau					
Coast	Sua Betong Pulau Panjang Tanjong Aggas and Coast Road Devon Estate.	About September 21st to about December 21st	14	21	295	309

District	Locality	Dates	Swarms Driven	Tins	Swarms Poisoned	Total Swarms
Tampin	See Kee Kutta gong Molan and Kopis Ulu Gemencheh Repah Estate Gemencheh Batang Malacca Keru and Pondo	Sept. 27th to December 4th	—	—	1199	1199
		Sept: 13th to October 31st November 6th to Dec: 31st November 21st to Dec: 17th Dec: 1st to 31st	— 85 — —	— 169 — —	39 99 98 124	39 184 98 124
Johore	Tangkak. Muar River (Bt. Serempang) Batu Anam					
Total			136	660	2051	2187

A Summary of Locust Work in 1915.

By F. W. SOUTH.

During the first half of the year the locust staff remained the same as it had been at the close of 1914. In June Mr. Wolde was transferred to take temporary charge of the Government Plantation at Pondok Tanjong. Mr. J. O'Brien was appointed in his place and remained in charge of the work in the Tampin District until the end of the year. The absence of locusts in any large numbers in Selangor enabled Mr. Lyford to take charge of the work in the Seremban district of Negri Sembilan from the month of May until the end of the year, while carrying on his work in Selangor at the same time. The absence of hoppers from Selangor during the greater part of the year has also enabled a reduction to be made in the number of conductors employed.

In Selangor there have only been from one to five flying swarms present at any time. These have, in most cases at any rate, come in from the Negri Sembilan, remained a few weeks and then returned. There was one generation of hoppers near Sungei Besi which was entirely destroyed in February and March. In September another swarm from the neighbourhood of Kajang laid eggs in some sawahs just on the State boundary near Bangi. The majority of these eggs were destroyed by rain and the five small swarms of hoppers which ultimately hatched out were easily poisoned in one day. At the close of the year there were two flying swarms present in the State, one near Semenyih and one on the Kuchai Road. The position of all flying swarms in the State has been well known throughout the year. There have been none North of Kuala Lumpur with the exception of one that visited Kuang for a few days. The only point that is worthy of note has been the sudden appearance on about 2 occasions of swarms of considerable size on the Kuchai Road. It has not been possible to determine exactly whence they came and there is a possibility that they were bred in the very deserted and somewhat inaccessible country between the Kuchai Road and the Sepang road and river, lying to the West of the Kajang, Nilai-Labu road. Attempts have been made to examine this country, but so far without success.

In the Negri Sembilan work went on steadily throughout the year. There were four breeding seasons which coincided approximately with the four quarters of the year. In the Tampin and Seremban districts there were no hoppers during the first quarter,

but destruction work was carried out in these districts during all the other 3 quarters. In the Coast district destruction work was continuous from January to the beginning of September and commenced again at the beginning of the last quarter when it was coincident with that in the other two districts. The decrease in the number of locusts in the Coast district has been very noticeable. The Tampin district has provided the most work and efforts have been concentrated there in order to reduce as far as possible the number of locusts breeding on the lalang country to the east and north of Tampin. At the end of the year there were 3 swarms known to be present in the Seremban district, very few locusts at all in the Coast District and probably about 12 swarms in the Tampin district.

In Johore there was no destruction work during the first quarter of the year, but from April 1st onwards destruction work continued with but short interruptions. The most important district was around Tangkak where there were four distinct generations of hoppers. There were two generations of hoppers on the Muar River, one in the Jorak neighbourhood and one at Bukit Serempang. There were also two generations of hoppers at Sungei Mati. At Batu Anam there were three periods of destruction work. The locusts in this State has been confined throughout to the northern end and have been kept fairly under control.

In Selangor there were 202 swarms destroyed in 1915 as compared with 3118 destroyed in 1914. These figures show clearly the reduction in the number of locusts present in the State. In the Negri Sembilan 918 swarms were destroyed in the Seremban district, 2279 in the Coast and 2874 in Tampin district making a total of 6071 swarms in all in 1915 as compared with 4242 swarms destroyed in 1914. The increase is due to the use of the poison method throughout the year in all places where it could be employed without danger and thus shows added efficiency in the work. There can be little doubt that the steady destruction of locusts in the Negri Sembilan has had, in conjunction with the work in Johore, a marked effect on the total number of swarms present in the Peninsula. In Johore the number of swarms destroyed was 1505 which with those destroyed in the Federated Malay States gives a total of 7,778 swarms as compared with about 7,930 swarms in 1914. No locusts bred in Pahang in 1915. The cost of the work in 1915 for the Federated Malay States alone was \$56,155.40 as compared with \$81,139.26 in the previous year. The reduction in staff made in August 1914 and the small amount of destruction work in Selangor account for this diminution in cost, as does also the extended use of the poison method of destruction.

The amount of damage done by the locusts has been practically negligible. About 10 young rubber trees were broken by flying insects in Selangor. No serious damage at all is reported from the Negri Sembilan and in Johore only a few coco-nuts were damaged. On the other hand the hill padi crop around Jorak and Sungei Mati was saved in its young stage during April and May and the hearty co-operation of the Malays in the work signified their appreciation of what was being done for them. The absence of serious damage to padi by locusts during the year is an important point and is a satisfactory result of the work.

It is anticipated that in the coming year the locusts in Selangor will only occur as an occasional flying swarm that may make its way northwards. It is expected also that those in the Negri Sembilan will be mainly confined to the Tampin district, while Tangkak will undoubtedly remain the chief centre in Johore. There seems to be good reason for hoping that at the close of 1916 only an occasional swarm of locusts will remain anywhere in the Peninsula.

District.	Date.	Swarms Driven	Tins.	Swarms Poison- ed	Total Swarms
Selangor.					
Kuala lumpur	Feb: 9th to March 21st	197	4633	nil	197
Kajang	September	...	...	5	5
Total for Selangor		197	4633	5	202
Negri Sembilan.					
Seremban and					
Jelebu	April 1st to May 23rd	113	2251	119	232
	June 16th to July 23rd	76	1183	376	452
	October 26th to Nov: 30th	37	470	197	234
Coast	January 1st to March 31st	135	555	446	581
	April 1st to June 30th	83	432	814	897
	July 1st to about September 7th	14	220	478	492
	About Sept: 21st to about Dec: 21st	14	21	295	309
Tampin	January			3	3
	March 9th to May 23rd	...	...	597	597
	June 23rd to Sept: 7th	111	390	964	1075
	Sept: 27th to Dec: 4th	...	...	1199	1199
Total for Negri Sembilan		583	5522	5488	6071

District	Date	Swarms Driven	Tins	Swarms Poison- ed	Total Swarms
Johore.					
Tangkak	March 28th to June 7th	147	444	71	218
	June 30th to August 28th	30	81	137	167
	Sept: 13th to October 31st	—	...	39	39
	Nov: 6th to Dec: 31st	85	169	99	184
Muar River (Jorak)	April 2nd to May 28th	162	426	199	361
(Bt: Serempang)	Nov: 21st to Dec: 17th	...	...	98	98
Sungei Mati	April 3rd to June 6th	13	38	113	126
	August 18th to Sept: 5th	...	...	43	43
Batu Anam	April 28th to May 30th	...	...	48	48
	July 7th to August 21st	...	...	97	97
	Dec: 1st to 31st	...	..	124	124
	Totals	437	1158	1,068	1,505
	Grand total	1,217	11,313	6,561	7,778

A method of determining the rubber content of latex.

BY P. W. N. FARQUHARSON.

The following paper on "The determination of the rubber content of latex, without the use of an hydrometer" has been received from Mr. P. W. N. Farquharson of Seremban Estate. Comments on the method by the Agricultural Chemist are also added.

It is a well known fact that Chinese tapping contractors have a system of paying their coolies by results, taking a sample of latex from each bucket and weighing it after coagulation.

For the last six months I have been working on a similar system with excellent results, the aggregate of each coolie's rubber, as calculated from the sample, approximating very closely with my daily factory weights.

At first sight the measuring of latex to one tenth of a gallon and weighing the sample to one hundredth part of an ounce may appear to be open to a very large margin of error, but in practice, if carefully done, the difference rarely exceeds 5%.

It may also be thought that the process entails too much detailed calculation, but with a ready reckoner, which can be easily worked out to suit each individual estate there is practically no calculation.

The system I have worked on (with an average daily outturn of 150 tappers) is as follows:

- (1) Each cooly is given a tin ticket with a number on it.
- (2) On arriving at the store he presents his number to the person taking the names. His pail of latex is well stirred and a sample measuring 1.6 ozs. (1/100 of a gallon) is dipped out and poured into a latex cup bearing the same number.
- (3) The latex is then weighed or measured to a tenth of a gallon and the number of gallons and tenths recorded against his number. (N.B. The simplest way is to weigh the latex, as one pound in weight of latex represents one tenth of a gallon. The buckets can be tared beforehand and the tare painted on them. The lump is left in when weighing or measuring).
- (4) After all the coolies are in, sufficient acid is added to each cup to coagulate it fairly quickly. Each sample is then taken out, made into a small piece of thin crepe and returned to its cup. This can be done very quickly with a macerator and smooth roller, 150 samples taking usually about half an hour.

(5) The samples can then be left overnight for some of the surface moisture to dry off and weighed next morning to 1/100th part of an ounce. (I use an ordinary letter scale and have made my own weights to weigh .05 and .01 of an ounce).

The weight of each sample is entered in the book opposite the coolie's number.

By moving the decimal point two places, the wet content of one gallon is ascertained and multiplying this by the number of gallons and tenths recorded, gives the weight in ounces.

By taking off the percentage usually lost in drying the dry weight can be obtained.

All this calculation can be avoided by working out a ready reckoner, when the process of calculating the dry rubber content of a given number of gallons and tenths, from a sample weighing so many hundredths of an ounce, is a very quick and simple one.

Note 1. Have a measure made, holding just under 1½ ozs. (1.62 ozs.). If the aggregate of individual weights is found to be in excess of factory weights, file off a little of the rim of the measure every day until the aggregate and factory weights approximate.

2. It is *absolutely essential to stir the latex* before taking the sample. The richer latex rises to the surface and unless the contents of the bucket are well stirred the sample will not be a fair one, and will weigh proportionately heavier than the remainder.

3. I use racks each containing 100 cups (20 cups long by five cups wide). In these the cups can easily be carried to the rolling machines and thence to the room where the samples are weighed.

Each space on the racks is numbered to compare with the number on the cup.

4. To make the small weights.

Cut out an oblong piece of tin or thin zinc weighing $\frac{1}{4}$ oz. Rule off its length on a piece of foolscap, and on this line construct an oblong enclosing five spaces between the ruled lines of the foolscap. Draw a diagonal across this oblong and then rule lines parallel to the sides of the oblong where this diagonal cuts the foolscap lines. This will divide the base line into five equal lengths to which the $\frac{1}{4}$ oz. of tin can be cut to divide it into 0.05 oz.

To get the 0.01 oz. weight take a narrow piece weighing .05 oz. and treat in the same way.

By taking 16 ozs. latex (= 1/10 gallon) and treating in the same way a very fairly accurate estimate of the contents of a large volume of latex can be obtained.

I have used these two systems (1) for paying tappers by results and (2) for ascertaining the quantity of water to be added to bring my latex to a standard weight per gallon. The results almost invariably differ less than 5% from my factory weights. This system enables me to bulk my latex, the weights from the different fields being ascertained by totalling the weights of the tappers in each field, and then adjusted slightly to agree with the total factory weight.

Comments:—This method is well known in practice and is adopted chiefly by Chinese contractors on estates where contract labour is employed.

Mr. Farquharson's adaptation consists in simplifying the method for estate practice by working in decimal parts of a gallon, to avoid the numerous calculations necessary in manipulating English weights and measures, by employing a measure which is a decimal part of a gallon viz. 1.6 ozs. or one-tenth of a gallon.

The method of making the small weights is simple, but depends obviously on using a strip of metal of even thickness, unless the small weights are adjusted subsequently in comparison with a standard weight. In using a hydrometer, if pure latex is brought to the factory it has to be diluted, since pure latex containing over about 20 per cent of dry rubber or 2 lbs. per gallon, is so viscous that the hydrometer will not float satisfactorily. Secondly, although no corrections have yet been made, an error in hydrometer readings is introduced by variations in the temperature of the latex, which may be as much as 10 to 15 degrees from what has been taken to be the normal shade temperature used in graduating the hydrometer, viz. 84° F. Another factor which also affects the accuracy of hydrometer readings is naturally the use of formalin and sodium sulphite solutions as anti-coagulants in the latex, since these solutions alter the density. Provided however any estate finds that the amounts of these solutions are fairly constant from day to day, any hydrometer can be graduated by the estate Manager concerned, by carrying out a few preliminary experiments on his own estate latex. Where the use of the hydrometer may be considered of the greatest value, is in bulking and diluting latex in the factory to a standard density, so that the weight of sheet per gallon is always constant, which tends to give much greater uniformity in the rubber especially in respect to its rate of cure.

The method used by Mr. Farquharson is employed in the Agricultural Department factory, in which the latex or rubber has to be measured for tapping experiments, and, since most of the

"first" latex is required now for vulcanisation experiments, it is not possible to weigh the total amount of rubber from each tapping experiment. The latex is measured carefully, a definite proportion (2 ozs.) is removed by means of an accurate measuring instrument known as a pipette and this quantity is coagulated separately and the dry rubber weighed. It is often not possible to use a hydrometer owing to the small quantity of latex and owing to the fact that, if a definite dilution were made, say 2 parts of latex to 1 part of water or 1 part of latex to 1 part of water, the rubber content might be lower than required for vulcanisation experiments, in which it is necessary to work on constant latex. The pure latex is measured, the aliquot portion of 2 ozs. removed as stated, and the bulked latex diluted subsequently to a standard density of 0.9910 for these experiments by means of the hydrometer.

B. J. E.

Standard Hibiscus.

BY J. N. MILSUM.

A number of Hibiscus having been grown recently in the Public Gardens, Kuala Lumpur, as standards, it is thought that a description of the method adopted might be of interest.

It should be mentioned that the writer first saw Hibiscus grown in this manner in the garden of Mr. H. C. Barnard at Kuala Lumpur, where several fine standard bushes of Hibiscus schizopetalus have been growing for some time.

The Hibiscus standards in the Public Gardens have all been grown direct from cuttings, but it has been found that there is no difficulty in budding on to strong growing sorts varieties that would be unsuited as standards on their own roots.

Hibiscus schizopetalus, with long-stalked, scarlet, drooping flowers and the large deep scarlet, maroon centered variety of H. rosa-sinensis are the most satisfactory varieties for growing as standards, owing to their rapid and robust growth and freedom of flowering.

Cuttings of partly matured growth were put into a prepared bed of sandy soil. These, when rooted, were carefully transplanted into a nursery bed and shaded with attaps; the bed had previously been deeply changkolled and well manured. The cuttings were planted three feet apart to allow of a good ball of earth to be

lifted when the bushes were to be removed to their permanent quarters. When the young plants had become well established, they were gone over with a sharp knife, all superfluous growth being removed and the main shoot tied back to a stout stake about six feet high. The plants were then kept steadily growing for five or six months, when they reached a height of about five feet six inches. During this time the surface soil received a periodical loosening and all lateral shoots were pinched out, the main shoot of each plant being carefully tied back to the stake. The plants were then cut back to a height of five feet from the ground and the lower leaves removed. Four or five lateral shoots were allowed to grow on each bush, these being pinched back after attaining a length of about four inches. The bushes were then moved into their permanent quarters and carefully staked and watered when necessary. In a month's time the bushes were growing and flowering vigorously and required no further attention beyond an occasional inspection for insects pests, these being the well known green Aphis and a small green caterpillar which feeds on the foliage and rolls the leaves up into a tube for protection.

Bushes thus treated and planted out in June 1915 have been flowering ever since and now have a head of growth four feet in diameter. Where only a few bushes are required, these could be grown from cuttings planted in the situation where they are eventually wanted to flower.

Comparative Returns of Imports, F. M. S. during the Third Quarters 1915 and 1914.

Articles	How counted.	Selangor.		Perak.		Negri Sembilan.		Pahang.		1915 Total.		1914 Total.	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Coconuts	Pikuls	...	\$...	...	\$ 1,709	...	\$...	...	\$ 50	...	\$ 1,759	...	\$ 8,780
Copra	"	...	...	...	...	...	...	...	...	...	...	171	1,804
Coffee	"	3.	99,	266	6,089	16	333	56½	1,954	341½	8,475	168	4,962
Padi	"	2,863½	8,587.	5,331	13,985	579	1,729	760	2,020	9,533½	26,321	24,833	63,204
Rice	"	321,065	1,559,217	324,890	1,561,731	73,240	361,190	25,241	126,410	744,436	3,608,548	861,264	4,263,777
Pepper	"	127½	2,910	73½	1,906	19½	465	...	...	220½	5,281	202½	4,911
Sugar	"	13,382½	102,163	28,549, ⁹ / ₁₀	271,200	3,971	30,411	2,088	19,489	47,990, ² / ₁₀	423,263	50,420½	304,497
Tapioca	"	499½	2,111	1,038	18,568	56	620	3	22	1,596 ³ / ₄	21,321	2,286½	20,543
Gambier	"	31	343	121½	2,111	31	299	29	468	212½	3,221	162	1,979

Comparative Return of Exports, F. M. S., during the Third Quarters 1915 and 1914.

Articles	How counted.	Selangor.		Perak.		Negri Sembilan.		Pahang.		1915 Total.		1914 Total	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Coconuts	Pikuls	...	\$ 1,228	...	\$ 6	...	\$ 198	...	\$ 31	...	\$ 1,463	...	\$ 677
Copra	"	15,986½	117,856	60,210	446,437	363	2,709	758	5,749	77,317½	572,751	61,888	630,071
Coffee	"	1,994	49,537	27½	425	...	...	...	..	2,021½	49,962	2,140¾	71,441
Padi	"	...	...	3,616	7,761	...	...	...	...	3,616	7,761	3,638	8,062
Rice	"	...	...	57,179	254,207	...	...	...	...	57,179	254,207	57,211	264,534
Pepper	"	4½	140	...	...	11½	219	70½	1,401	86½	1,760	176	3,096
Sugar	"	...	238	5	83	...	...	...	...	5	321	83	569
Tapioca	"	...	...	1,601	6,130	2,744	18,487	3,734	20,404	8,079	45,021	9,473	35,713
Gambier	"	...	...	...	...	3,137	33,710	...	...	3,137	33,710	2,615	20,104

Exports of Rubber from British Malaya, (other than the F. M. S.)

State.	Month.	Quantity.
Johore	December, 1915.	lbs. 6,765,604
Kelantan	December, 1915.	lbs. 118,413
Kedah	December, 1915.	lbs. 596,635
Perlis	October to Dec. 1915.	lbs. 2,695
British N. Borneo	December, 1915.	lbs. 340,108
Brunei	December, 1915.	lbs. 20,803

FEDERATED MALAY STATES.

AMENDED Comparative Statement of Cultivated Rubber Exported, with Value and Duty Collected Thereon,
During the Years 1915 and 1914.

Destination.	Exported during December, 1915.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase.	Decrease.	Value of rubber exported, 1915.	Duty collected, 1915, to date.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	\$	\$ c.
Straits Settlements ...	3,426.39	26,892.89	30,319.28	17,844.94	12,474.34	...	63,664,334	
United Kingdom ...	1,523.81	11,776.64	13,300.45	11,252.92	2,047.53	...	27,808,708	
Continent of Europe...	...	8.00	8.00	807.78	...	799.78	15,880	
Ceylon ...	96.75	619.08	715.83	691.58	24.25	...	1,510,122	
Other Countries ...	64.02	116.11	180.13	100.27	179.86	...	406,943	
Total ...	5,110.97	39,412.72	44,523.69	30,697.49	14,725.98	799.78	93,405,987	2,401,914.17

KUALA LUMPUR,

21st January, 1916.

E. BURNSIDE,

Acting Commissioner, Trade and Customs, F.M.S.

FEDERATED MALAY STATES.

*Comparative Statement of Cultivated Rubber Exported, with Value and Duty Collected Thereon,
During the Years 1916 and 1915.*

Destination.	Exported during Januray, 1916.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase.	Decrease.	Value of rubber ex- ported, 1916.	Duty collected, 1916, to date.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	\$	\$ c.
Straits Settlements	3,310.60	...	3,310.60	1,953.37	1,357.23	...	11,014,480	
United Kingdom	1,072.66	...	1,072.66	1,384.95	...	312.29	3,568,826	
Continent of Europe	...	...	...	1.00	...	1.00		
Ceylon	51.69	...	51.69	80.81	...	29.12	171,968	
Other Countries	35.70	...	35.70	53.09	...	17.39	118,783	
Total	4,470.65	...	4,470.65	3,473.22	1,357.23	359.80	14,874,057	391,254 81

KUALA LUMPUR,
7th February, 1916.

E. BURNSIDE,
Acting Commissioner, Trade and Customs, F.M.S.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.			HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall dur- ing 24 hours.
			Maximum.	Minimum.	Range	Mean Dry Bulb.	Mean Wet Bulb.	Vapour Tension.	Dew Point.			
Kelantan, Kota Bahru	...	131.	85.6	72.3	13.3	78.6	75.3	.812	73.0	—	13.62	4.96
Pahang, Kuala Lipis	...	...	84.1	72.2	11.9	78.5	74.6	...	...	...	12.13	1.90
Johore, Johore Bahru	...	...	86.02	72.93	13.09	...	...	...	...	...	12.25	...
Singapore, Kandang Kerbau	29.815	158.0	86.5	73.6	12.9	80.8	77.2	.883	...	...	13.28	3.68
Malacca, Durian Daun	29.797	142.9	87.	71.4	15.6	82.1	79.2	.960	—	N.	5.95	2.85
Negri Sembilan, Seremban	...	136.1	87.0	71.9	15.1	85.3	75.3	.815	73.1	N.W.	4.36	1.16
" Kuala Pilah	...	148.9	89.5	72.7	16.8	80.7	77.3	.873	75.0	N.W.	3.93	.70
" Port Dickson	...	127.7	86.9	73.7	13.2	80.7	76.8	.844	74.1	N.W.	10.10	4.64
Selangor, Kuala Lumpur	29.808	135.1	87.0	73.8	13.2	79.7	75.8	.873	74.9	S.E.	7.17	2.15
" Klang	...	...	84.2	73.4	10.8	79.7	75.7	...	...	...	6.16	2.43
" Kuala Selangor	...	...	87.6	75.0	12.6	...	...	...	...	...	6.08	2.38
" Rawang	...	...	92.1	...	...	...	...	...	...	...	3.57	1.19
Perak, Telok Anson	...	...	90.	70.	20.	80.39	76.86	.876	—	...	12.82	4.26
" Ipoh	...	...	92.	69.	23.	80.74	75.59	.816	74.11	...	8.86	3.50
" Taiping	...	153.	91.	71.	20.	79.85	75.76	.837	—	...	11.89	3.02
" The Cottage	...	...	...	...	...	...	...	...	...	...	17.42	3.24
" Parit Buntar	...	...	92.	70.	22.	82.53	77.54	.879	...	...	2.27	.53
Penang, Georgetown	29.824	136.9	87.1	72.4	14.7	81.5	75.8	.816	73.2	W	3.25	1.07
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	1.27	.85
Perlis, Perlis	...	...	84.48	71.03	13.45	...	...	...	...	...	1.41	...

